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sandstone may fade into a soft sandy clay shale with the same bedding and structure as the stone itself and change back into a sandstone a few rods away. Most of the sandstones are so incoherent when freshly quarried that pieces two or three inches in diameter crush readily under foot. In many of the wells of the region the water is obtained in "quicksand." Most of the shales contain much fine sand and offer little resistance to weathering.

At their southern limit these red sandstones and shales are found to dovetail into the Permian conglomerates on the northern side of the Arbuckle mountains, while similar conditions obtain among the higher beds farther west where similar conglomerates occur on the flanks of the Wichita mountains. These conglomerates are largely composed of the fragments of the pre-Carboniferous limestones aggregating 8,000 or 10,000 feet in thickness flanking the mountains and at one time covering them. The solution of these limestones produces a red clay wherever the insoluble residue happens to remain undisturbed below the vegetable mold, and the disintegrating limestone conglomerates produce a more or less sandy red clay indistinguishable from some of the red bed sediments. Thus it seems not improbable that much of the material of the red beds in the region studied was derived from these thick limestones.

Considering all these phenomena, it is apparent that the transition of deposits from the Arbuckle mountains to the Kansas line is such as would be expected in passing from the mountains out into a shallow epicontinental sea.

That the solution of limestone produces red residual clays is well known. It is exhibited in the residual soils and clays of the limestone regions of the unglaciated part of the Mississippi Valley, Cuba, southern Europe and elsewhere. The clays thus derived and their coloring matter—the red oxides of iron—are minutely divided and when in suspension settle slowly, but little movement of the water being sufficient to keep them in suspension. This characteristic adapts them to

long transportation. The great thickness of the Arbuckle and associated limestones, and their former extent, over thousands of square miles of country where they are now removed or represented only by their upturned edges surrounding the mountains, seem to furnish an ample source of the coloring matter and a considerable amount of the clays of these lower Oklahoma red beds. The Gabbros, red granites and red porphyries of the Arbuckle-Wichita region also contributed their share of sediment to the red beds.

From these observations it would appear that the sediments of the lower red beds of Oklahoma were derived largely from the Arbuckle-Wichita Permian land mass and the coloring matter mainly from the solution of the limestones known to have been removed from it. It also seems probable that the sediments of the region studied, especially those some distance from the mountains, were deposited in very shallow turbulent water, or vast tidal beaches, inimical to life of all kinds, since they are void of fossils or even carbonaceous matter.

J. W. BEEDE

THE ENTOMOLOGICAL SOCIETY OF AMERICA

THE sixth annual meeting of the Entomological Society of America was held at Washington, D. C., Tuesday and Wednesday, December 26 and 27, in room 376 of the new U. S. National Museum building. The following papers were presented:

HERBERT OSBORN: *Faunistic Studies in Entomology.*

The need of an extended and accurate record of insect fauna is urged, with statement of instances where such data have been much needed. Attention is called to the possibilities for widely scattered workers to assist in such studies and the desirability of some connected plan by which to encourage and bring together the results of such studies. A suggestion is made that the society appoint a permanent committee on faunistics, the duty of which will be to devise means for the encouragement of faunistic studies and to bring together the correlated results in this line with reports to the society as to methods proposed and the results secured.

E. P. FELT: *Numerals as Aids in Classification.*

The habitual use of numbers in catalogues indicates utility. A modified system of decimal notation is adapted to the needs of naturalists, while additions require little change. A general agreement upon the numbers for the major zoological division is suggested prior to the application of the system by cataloguers and other general workers.

E. S. TUCKER: *Studies of Insects Bred and Collected from the American Mistletoe.* Presented by Andrew Rutherford.

By the name of "American mistletoe," the species *Phoradendron flavescens* Nuttall and its several varieties is meant. Two snout-beetles belonging to the same group as the cotton-boll weevil were bred from terminal enlargements of the stem. From the larvæ of one of these beetles five hymenopterous parasites were bred, all of which attack the larvæ of the cotton boll-weevil. About sixty species in all were obtained.

H. C. SEVERIN: *The Influence of Temperature on the Moulting of the Walking-stick, Diaphanera femorata.* Read by title.

R. MATHESON and C. R. CROSBY: *Notes on Aquatic Hymenoptera.* Illustrated. Presented by C. R. Crosby.

Three species of aquatic hymenopterous egg parasites have been reared at Ithaca, N. Y.: (1) a trichogrammid from the eggs of a damselfly (*Ischnura* sp.); (2) a proctotrupid from the eggs of a water strider (*Gerris* sp.); (3) a mymarid from the eggs of a back swimmer (*Notonecta* sp.). All of these forms are able to swim actively under water by means of their wings. They are also able to use their wings for flight in the air.

ANNA H. MORGAN: *Photographs Illustrating the Life Histories of May-flies.* Illustrated.

Photographs were shown which illustrated the life history and biology of about twenty-five May-flies. Both nymphs and adults were photographed alive; the nymphs in a solution of chloretone, the adults without anæsthetic. Nymphs representing the main biological groups were shown and their habitat described. Imagoes and subimagoes of certain genera were shown and their structure and characteristic postures noted.

H. Y. TSOU: *The Chinese Wax-scale, Ericerus pe-la.* Illustrated.

One of the most beneficial insects of the family Coccidæ has been domesticated by the ancients of the Chinese people for the wax which it produces. This paper consists of (a) correction of errors of

European translations from Chinese works; (b) additional statements on the life history of the insect; (c) method of propagating this insect; (d) division of labor in carrying on this industry among the people of different localities, so that the eggs of the insect are produced in the northern district and the wax in the southern district; (e) importance of this industry; and (f) use of the wax.

A. D. MACGILLIVRAY: *The Lacinia in the Maxilla of the Hymenoptera.* Illustrated.

The Maxilla of *Macroxyela*, one of the most generalized of Hymenoptera, has the lacinia well developed. The lacinia among the wasps is a well-marked, triangular lobe attached to the distal and mesal end of the stipes. The maxilla of the Apoidea is greatly elongated for sucking, the galea enlarged and the lacinia reduced. The lacinia is a rounded lobe fringed with setæ and occupying the same position as it does in *Vespa*. It is not wanting or united with the galea in the honey-bee, as is usually stated in text-books and works upon apiculture.

LUCY WRIGHT SMITH: *Glycogen in Insects, especially in the Nervous System and the Eyes.* Illustrated.

In a heterogeneous lot of insects, including representatives of seven orders, glycogen has been found: (1) in immature and adult stages (a) in the crystalline cells of compound eyes, (b) in the crystalline and retinal cells of simple eyes, (c) in the neurilemma; (2) in immature stages only, (a) in the cells of ganglia in all parts of the body. No glycogen has been found in nerve fibers.

J. A. NELSON: *Note on an Abnormal Queen Bee.* Illustrated.

This queen was originally sent from Grand Bay, B. W. I. When received she was alive and quite active. It was planned to introduce her into a hive to test her fertility, but she died by accident before this was done. The dead queen appeared normal in structure with the exception of the abdomen, which was ovoid in shape, instead of conical as in the normal queen; it was also flexed strongly ventrad at the apex, which had consequently a blunt appearance, like that of the abdomen of the drone. The sternites of the 5th and 6th abdominal segments were unusually broad and somewhat asymmetrical, as was also the sternite of the 4th segment. The sternite of the 7th segment was the most modified of all, being greatly shortened in the longitudinal axis, and almost concealed by the sternite of the preceding segment.

The notch on its posterior border was abnormally broad and deep. The sting had a slight kink mid-way of its length.

The internal organs were apparently normal with the exception of the genital organs. The left ovary and oviduct were entirely wanting. The right oviduct and ovary were present, but the latter appeared to possess only a single egg tube. The spermatheca was empty. The bursa copulatrix was also shortened in the longitudinal axis, so that the external openings of the spermatheca and the poison glands were brought close together. No characters suggestive of hermaphroditism were found. The cause of the abnormalities is unknown.

J. CHESTER BRADLEY: *The Designation of the Venation of the Hymenopterous Wing*. Illustrated.

In the higher Hymenoptera, owing to certain remarkable conditions that prevail, the full application of the Comstock-Needham system of venation becomes a very complex matter. This is especially true in the case of the hind wings. By certain simple abbreviations this complexity is avoided, and the system becomes quite conveniently usable for taxonomic purposes.

ANN H. MORGAN: *Homologies in the Wing-veins of May-flies*. Illustrated.

The main tracheæ of May-flies precede and constantly mark the course of the main veins. The costal and subcostal tracheæ are simple, as are the veins which follow them. The radial trachea (except in one form) and the vein which follows it are unbranched. The radial sector is very probably present in May-flies, but in an unusual position between the veins M_1 and M_2 . It is detached from radius as in the dragon-flies and stranded upon M_1 . The medial vein has its characteristic four branches. This interpretation involves important changes in the nomenclature of radius and media.

A. D. MACGILLIVRAY: *The Pupal Wings of Hepialus thule*. Illustrated.

The adult wings of *Hepialus* are very similar to the hypothetical type of Comstock and Needham. The pupal wings show several features wanting in the adult wing. There is a two-branched subcosta, the first branch of subcosta disappearing and the subcosta of the Lepidoptera is therefore Sc_2 . The radial and medial tracheæ enter the wing through the same vein, the media together with a cross-vein forming the areculus between radius and cubitus. The presence of an areculus has not been reported in the Lepidoptera hitherto.

J. CHESTER BRADLEY: *The Wing Venation of Chalcid Flies*. Illustrated.

The hymenopterous family Chalcididae present a uniform excessive reduction in the number of their wing veins which is approached elsewhere in the Hymenoptera only by certain Proctotrypidæ and Evaniidæ. This depletion is the result of a degenerative tendency that is manifest wherever there is considerable reduction in the size of the wasp. It is of interest to ascertain with what veins of other Hymenoptera the vein remnants in the Chalcid wing are homologous.

The so-called marginal vein is in reality the elongated stigma, the "post-marginal" is r and R_1 and usually bears on its anterior margin a spur of the base of R_2 .

Leucospis is our most generalized group of Chalcididae so far as its wings are concerned. The wings of Chalcididae show a close relation to those of Cynipidae, through *Leucospis* in the one group and *Ibalia* in the other.

F. M. WEBSTER: *Our Present Educational System in Relation to the Training of Economic Entomologists*.

The demand for trained men capable of engaging in entomological work has increased greatly, but the graduates of the colleges generally are not equipped for such work and must have a special training of one to two years before they are available. The author wishes to emphasize the necessity for training in related sciences, in modern languages, and especially in field observation in entomology. The student intending to be an entomologist should begin in his first year with field observations and should be required to gather his own material for study. It would be especially desirable that students training for entomological work should have an experience at least during their vacations in work in some experiment station, and this sort of work should very properly be given credit in the college or university as part of the requirements leading to a degree.

C. W. JOHNSON: *The Use of Color in Designating Types and Varieties*.

Colored labels for types is being carried to an extreme. At the last meeting of the Cambridge Entomological Club one of our members who makes a specialty of printing labels for entomologists, asked me "what is an allotype, a homotype, a metatype, an autotype and a topotype, and why don't they use the same color for the same kind of a type? One wants his paratype on light

green, another on pink and a third on brown. Why I can't get enough colors to go around." An energetic collector with time and money at his disposal can make some sort of type out of seventy-five per cent. of his species. These various types may have some value, but they can not always be depended upon. A great number of colors used indiscriminately is very confusing, for there are equally important features that might be designated by color, aside from manufactured types. Colors could be used to advantage to indicate abnormalities, especially to-day when the experimental biologist is after data as to the number and kinds of abnormalities that occur in specimens in nature. Such specimens are completely overlooked unless they are marked in some way. Not more than two colors should be used for types: red for the primary, and green for supplementary types. Then another color, yellow, for instance, could be used for abnormalities.

HERBERT OSBORN: *A Problem in the Flight of Insects.*

Insect flight has been explained continuously by the movements of the wings vertically, the rigid anterior border with flexible hinder portion of the wing serving to so relate itself to the atmosphere as to furnish a forward movement. While this explains readily the forward progression, it does not in itself explain the hovering or the backward flight of many insects which is a matter of common observation. Numerous instances cited illustrate this feature. The explanation suggested for this movement is that the wings are rotated forward until the flexible under-portion of the wing reacts upon the atmosphere in such manner as to maintain the insect in a stationary attitude or even to propel it in a backward direction. Such rotation may be seen to be amply provided for in the structure of wings and the close observation of insects in hovering indicates the forward rotation.

E. P. FELT: *The Biology of Miastor and Oligarces.*

The widely distributed *Miastor* larvæ reproduce by pedogenesis in the moist, decaying bark of various trees during fall and spring, midges appearing from June till August. A larval generation occupies three to three and a half weeks. *Oligarces* is less common than *Miastor*. Both are subject to attack by a number of natural enemies.

LEONARD HASEMAN: *Entomological Work in Missouri.*

Since the early masterly work of Dr. C. V. Riley the entomological needs of Missouri have not been

properly served. Every line of entomological work is open for study. This department is investigating the more urgent insect problems of Missouri, though it is much handicapped by lack of assistance. The work connected with the instruction, station, nursery inspection and duties of state entomologist is more than the present staff can properly handle.

W. L. W. FIELD: *Hybrid Butterflies of the Genus Basilarchia.*

Since the Boston meeting two years ago, considerable progress has been made in the experiments with the supposedly hybrid *Basilarchias*, *B. proserpina* Edw. and *B. arthechippus* Scud. Their hybrid nature has now been proved by breeding experiments. The data obtained also support the conclusions drawn from earlier experiments, to the effect that in *proserpina* the black of *astyanax* is incompletely but uniformly dominant over the white-banded condition of *arthemis*.

O. A. JOHANNSEN: *Cocoon Making of Bucculatrix canadensisella.* Read by title.

J. G. NEEDHAM: *Some Adaptive Features of Myrmeleonid Venation.* Read by title.

E. H. STRICKLAND: *The Pezomachini of North America.* Read by title.

P. P. CALVERT: *Seasonal Collecting in Costa Rica.* Read by title.

Z. P. METCALF: *Homologies of the Wing Veins of Homoptera Auchenorrhynchi.* Read by title.

The following annual public address was given at the Cosmos Club, Wednesday evening, December 27:

J. H. COMSTOCK: *The Evolution of the Webs of Spiders.* Illustrated.

It is probable that the production of silk by spiders was not primarily evolved for the making of webs for capturing prey. The representatives of many families do not spin webs; and there is no reason to believe that these non-web-making families have descended from web-making forms. All spiders use silk in caring for their eggs; and it is probable that this was the primary use of silk in this group of animals.

Spiders having acquired silk for the protection of their eggs have utilized it for other purposes, of which the making of webs for capturing prey is but one, and probably not the next one in the sequence of the different uses of this substance. The acquiring of the habit of spinning a drag-line, the thread which most spiders spin wherever they go, doubtless preceded the making of webs. A spider spinning a drag-line would make a web if

by chance it moved about in a limited space as in some nook in which it had taken up its abode. In such a web insects would be trapped, and thus might arise the habit of building webs for the purpose of trapping insects. Many spiders spin simple irregular webs composed entirely of the drag-line silk. From this simple type was traced series of specializations leading to the different types of complicated webs. In the making of some of these several different kinds of silk are used.

The following officers were elected for the year 1912:

President—Stephen A. Forbes.

First Vice-president—A. D. Hopkins.

Second Vice-president—C. P. Gillette.

Secretary-Treasurer—Alex. D. MacGillivray.

Additional Members of Executive Committee: J. H. Comstock, J. B. Smith, Henry Skinner, Herbert Osborn, E. D. Ball, P. P. Calvert.

Member of Committee on Nomenclature—H. T. Fernald.

The society adjourned to meet with the American Association for the Advancement of Science at Cleveland, Ohio.

ALEX. D. MACGILLIVRAY,
Secretary-Treasurer

SOCIETIES AND ACADEMIES

THE ACADEMY OF SCIENCE OF ST. LOUIS

THE meeting of the Academy of Science of St. Louis was held at the Academy Building, Monday evening, January 15, 1912, President Engler in the chair. Dr. Arthur E. Ewing presented an illustrated account of *Sanninoidea exitiosa* (Say) and *Sanninoidea opalescens* (Hy. Edwards).

After describing the varieties of the *S. exitiosa* and the difference between them and the *S. opalescens*, giving the history of the insects and Beutenmüller's classification, examples were exhibited of the eggs on the bark of the tree, on the gum from the base of the tree, on leaves from the lower limbs of trees, and one on a trumpet vine leaf that grew a foot from the base of a tree, all of which were observed as they were laid and immediately collected, the collection having been made at the Mountainboro orchard, Mountainboro, Alabama, and at Gadsden, Alabama, between the first and the fifth of September, 1911. The exit of the larvæ from these eggs was observed to be from seven to nine days, the time of the one laid on the trumpet vine was eight days.

For four successive seasons the life period of

the insect had been carefully noted at Mountainboro, and it was found to confirm for northern Alabama the observations of Porter, Starnes and Sherman for Georgia and North Carolina, and shows that in the Southern Allegheny peach belt pupation begins about the first of August and the moth appears the last week in the same month. In 1908, August 4, as many full-grown borers were captured in this orchard of 15,000 trees as there were cocoons, the total number being 1,100; August 7, 300 cocoons were captured and as many borers destroyed. The same conditions obtained during the first week of August, 1909. In 1910 the investigation was made later and resulted in the finding of 8,500 cocoons between the 20th and the 24th of August and very few borers. Two hundred of the cocoons were placed in a wire cage on a southern covered porch. From these 25 moths emerged previous to September 5, 46 between the 5th and the 8th inclusive, 29 between the 9th and the 13th, and after this only two, one male the 16th and another the 21st. The remainder failed to develop.

Observations on the moths in the cage were that their activity depends greatly upon the temperature; with it below 70° F. they are very quiet, and very active when it is above 80° F. At night they sleep with their antennæ spread rather wide, some with the wings moderately spread, usually, however, with the wings near the body as when at rest, and the male with the tip of the abdomen strongly turned upward. When awake and alert the antennæ were erect and near together as if indicating the facial expression of the insect. At night they took no notice of an electric light right above them when it was turned on and off. Thus caged they lived only three or four days.

The 28th of August, 1911, fifty infested trees were examined. From the half of the cocoons the moths had escaped. During the examination only one borer was found which had not yet begun its cocoon. Throughout the orchard the moths were numerous, and in greater numbers from the 1st to the 5th of September. On September 13 only one moth was found, although a careful outlook was kept during the middle of the day, the time when the imago is most active.

An exhibition was made of the larvæ at numerous ages, from the emergence from the egg to the time of spinning the cocoon, together with an example of their destructive work on the tree, and numerous mounted examples of the male and female moth of the *S. exitiosa* type.

Also a cocoon was shown filled with the larvæ